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10/598,035

08/16/2006

Peter Dirksen

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PHILIPS INTELLECTUAL PROPERTY & STANDARDS

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BRIARCLIFF MANOR, NY 10510

EXAMINER

PATEL, NIRAV G

ART UNIT

PAPER NUMBER

4182

MAIL DATE

DELIVERY MODE

01/21/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|---------------------------------------|--|
| Office Action Summary | Application No. 10/598,035 | Applicant(s) DIRKSEN ET AL. | |
| | Examiner Nirav G. Patel | Art Unit 4182 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 August 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>3/2/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

It would be of great assistance to the Office if all incoming papers pertaining to a filed application carried the following items:

1. Application number (checked for accuracy, including series code and serial no.).
2. Group art unit number (copied from most recent Office communication).
3. Filing date.
4. Name of the examiner who prepared the most recent Office action.
5. Title of invention.
6. Confirmation number (See MPEP § 503).

Information Disclosure Statement

1. The information disclosure statement filed March 2, 2007 complies with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609. It has been placed in the application file, and the information referred to therein has been considered as to the merits.

Specification

2. The abstract of the disclosure is objected to because it contains language such as "means." The abstract also exceeds 150 words in length. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 4, 6, 7, 10 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Dirksen et al. (U.S. Pub. No.: 2001/0053489, "Dirksen").

1) Regarding Claim 1, Dirksen discloses a method of determining a parameter relating to image blur in an imaging system (IS), the method comprising the steps of:

illuminating an object having a test pattern (MTP) by means of the imaging system (IS) (Paragraph 85: Fig. 1 shows an embodiment of an apparatus for imaging a mask patterns. Paragraph 86: The apparatus further comprises an illumination system so that an object can be illuminated), thereby forming an image of the test pattern, the test pattern (MTP) having a size smaller than a resolution of the imaging system (IS) (Paragraph 7: The fact that the resolution of the scanning detection device is considerably larger than that of the imaging system means that the detection device allows observation of details (MTP) which are considerably smaller than the details (resolution) that can still be separately imaged by the imaging system), the test pattern (MTP) being an isolated test pattern,

the image being blurred, detecting the blurred image (Paragraph 94: For detecting the aberrations, the projection apparatus itself may be used as a part of a measuring system for performing a detection method), and

determining the parameter relating to the image blur from a parameter relating to a shape of the blurred image (Paragraph 145: Each of these sub-aberrations are usually represented by a Zernike coefficient which describes a shape of the blurred portion of the image).

2) Regarding Claim 4, Dirksen discloses in addition to the method of claim 1, wherein a geometrical aberration of the imaging system (IS) is determined from the parameter relating to the shape of the blurred image (Paragraph 118: FIG. 8 shows an image formed by a projection lens system having astigmatism (aberration). Since the image in FIG. 8 is again an image formed in the top right angle of the image plane, the major axis of the ellipse extends under 45.degree. (parameter relating to shape of blurred image)).

3) Regarding Claim 6, Dirksen discloses in addition to the method of claim 1, wherein the parameter relating to the shape of the blurred image comprises a mean radius thereof (Paragraph 147: Thereby use is made of the fact that the aberrations are dependent on the imaging parameters, such the diameter of .PHI. of the test circle on the mask. Using the diameter, a radius can be computed).

4) Regarding Claim 7, Dirksen discloses in addition to the method of claim 1, wherein the imaging system (IS) is a lithographic apparatus, the object is a mask (MA) (Paragraph 85: a lithographic apparatus for repetitively imaging a mask pattern on a substrate), and the step of detecting the blurred image comprises the steps of illuminating a resist layer (PR) by an image of the test pattern (MTP) (Paragraph 85: This substrate is provided with a radiation-sensitive layer PR, for example a photoresist layer, on which the mask pattern (MTP) must be imaged a number of times), and developing the illuminated resist layer, thereby forming a pattern relating to the blurred image (Claim 1: developing the photoresist layer; observing the developed image (pattern relating to the blurred image)).

5) Regarding Claim 10, Dirksen discloses a method of designing a mask pattern for use in a lithography process, comprising the steps of: providing a desired mask pattern, determining the parameter by means of the method according to claim 7 (Claim 1: a mask holder for accommodating the mask. Having a mask holder provides for a mask pattern to be provided), and

calculating the mask pattern from the desired mask pattern and the parameter, thereby obtaining the designed mask pattern (Paragraph 94: substrate is removed from the apparatus and is developed and etched so that an image of the test pattern in the form of a relief pattern in the substrate is obtained).

6) Regarding Claim 12, Dirksen discloses a device for determining a parameter relating to image blur in an imaging system (IS), the device comprising means for determining the parameter relating to the image blur from a parameter relating to a shape of the blurred image (Figure 1: The device discloses is an imaging system for relating the image blur from a parameter relating to a shape of the blurred image (See analysis from claims 1 and 4)).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dirksen in view of Patti et al. (U.S. Patent Number: 5,696,848, "Patti").

1) Regarding Claim 2, Dirksen fails to teach the limitations of claim 2. However, Patti discloses wherein the parameter relating to the shape of the blurred image comprises a blurred point spread function (Col. 4, Lines: 56 - 60: A processing step which includes sensor geometry, optical blur point spread function (PSF), and the high resolution sampling geometry (HR) to compute the combined blur PSF that accounts for the motion and optical blur), and the step of determining the parameter relating to the image blur comprises the step of fitting blurred intensity basic functions of the imaging system (IS) to the blurred point spread function (Claim 1: combining the calculated PSF for each pixel with the optical PSF to produce the combined PSF for each pixel. Parameters related to the geometry of blur is taken into account when the PSF is calculated (Col. 4, Lines: 56-60). Also, Claim 1 discloses generating the high resolution image from the lower resolution images employing the combined PSF by projection onto convex sets (POCS)).

Using a blurred point spread function relating to the shape of the blurred image allows for a determination of how well the imaging system is. If the degree of spreading (blurring) is large, the system needs to be reevaluated to produce a better result.

Relating the blurred image to a PSF gives a quantification of the quality of the result and an indication of whether or not the system parameters need to be changed. Therefore it would have been obvious to one of ordinary skill at the time of the invention to apply the teachings of Patti to Dirksen's methods.

2) Regarding Claim 3, Dirksen fails to teach the limitations of claim 3. However Patti discloses wherein the step of fitting blurred intensity basic functions of the imaging system (IS) to the blurred point spread function comprises the steps of: calculating sets of blurred intensity basic functions for a set of parameters relating to the image blur (Claim 1: combining the calculated PSF for each pixel with the optical PSF to produce the combined PSF for each pixel. Parameters related to the geometry of blur is taken into account when the PSF is calculated (Col. 4, Lines: 56-60)), and fitting for each of the parameters relating to the image blur the corresponding set of blurred intensity functions to the blurred point spread function (Claim 1: generating the high resolution image from the lower resolution images employing the combined PSF by projection onto convex sets (POCS)).

Fitting blurred intensity basic function to the PSF allows for the creation of a high resolution image which can be used in later processing to develop a resist layer where blurring is minimized. Therefore it would have been obvious to one of ordinary skill at the time of the invention to apply the teachings of Patti to Dirksen's methods.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dirksen in view of Dirksen et al. (U.S. Pub. No.: 2005/0117148, "Dirksen 2005").

1) Regarding Claim 5, Dirksen fails to teach the limitations of claim 5. However, Dirksen 2005 discloses wherein the blurred image is detected by detector means (PR) being situated in a detector plane, the image being formed in an image plane (Paragraph 112: The projection apparatus further comprises a focus error detection

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device, not shown in FIG. 1, for detecting a deviation between the focal plane and the projection lens system PL and the plane of the resist layer PR), a distance between the detector plane and the image plane being subject to stochastic fluctuations, the image blur relating to the stochastic fluctuations (Paragraph 177: Subsequently the mask pattern and the substrate are moved with respect to each other. This disclosed movement creates stochastic fluctuations).

Allowing the distance between both fields be subject to stochastic fluctuations allows getting multiple images which may or may not contain blurs. Using the data from the varying distance changes, an optimal distance for illumination can be obtained so that details of the test pattern can be transferred onto a substrate (PR). Therefore it would have been obvious to one of ordinary skill at the time of the invention to apply the teachings of Dirksen 2005 to Dirksen's method.

8. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dirksen in view of Yasunami et al. (U.S. Pub. No.: 2005/0064326, "Yasunami").

1) Regarding Claim 8, Dirksen fails to teach the limitations of claim 8. However, Yasunami discloses wherein the resist layer (PR) comprises a chemical component which is activated by the illumination (Paragraph 354: For example, the positive resist composition is coated on a substrate to thereby form a resist layer. Paragraph 355: The resist layer is irradiated (illuminated) with an actinic ray or radiation through a prescribed mask, the exposed resist layer is subjected to baking (heating), and then development. Thus, a good pattern can be obtained.) and which diffuses after the activation and

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before the development (Paragraph 26: A pattern-forming method comprising forming a film from the positive resist composition as described, exposing (diffuses) the layer, and developing the exposed layer (but prior to development)), the chemical component changing a solubility of the resist layer (Claim 1: positive resist composition comprising a resin capable of increasing a solubility thereof in an alkali developer by an action of an acid), the image blur relating to the diffusion of the chemical component.

Using the resist layer as disclosed by Yasunami allows for a resist layer which contains the details of the test patterns when transferred onto the layer. The resolution of the resist layer is higher and therefore a more desirable result. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Yasunami to Dirksen's methods.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dirksen in view of Yen et al. (U.S. Pub. No.: 2003/0123039, "Yen").

1) Regarding Claim 9, Dirksen fails to teach the limitations of claim 9. However, Yen discloses wherein the step of illuminating the resist layer is executed at a first exposure dose and at a second exposure dose different from the first exposure dose (Paragraph 29: A first exposure is performed with a first illuminating setting that is optimized for one of the duty ratios of the photomask. A second exposure is next performed with a second illuminating setting that is optimized for another duty ratio of the photomask. The exposure step is repeatedly performed with different illuminating setting).

Illuminating the resist layer with two doses, which are varying amounts allows for combining patterns of the transfers at the multiple exposures. Having a varying exposure amount yields multiple test patterns without the need of multiple resist layers, which is also economical. Therefore it would have been obvious to one of ordinary skill at the time of the invention to apply the teaching of Yen to Dirksen's methods.

10. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dirksen.

1) Regarding Claim 11, Dirksen fails to explicitly disclose the limitations of claim 11. However, utilizing a computer program which executes the steps of the disclosed method of claim 1 would be efficient and reliable ways as opposed to an individual performing these steps due to the fact that this having a program would allow automation and perform complex calculations like the PSF to be conducted without error. Therefore it would have been obvious to one of ordinary skill at the time of the invention to implement a computer program to perform the method of claim 1.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nirav G. Patel whose telephone number is (571)270-5812. The examiner can normally be reached on Monday - Friday 8 am - 5 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benny Tieu can be reached on 571-272-7490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nirav G. Patel/
Examiner, Art Unit 4182

/BENNY Q. TIEU/
SPE
Art Unit 4182